SECTION 02221S

TRENCHING, BEDDING AND BACKFILLING
for
SANITARY SEWERS (GRAVITY)

PART 1 – GENERAL

1.1 SCOPE OF WORK

The work covered by this Section consists of loosening, loading, removing, and disposing of, in the specified manner, all wet and dry materials (including rock) encountered that must be removed for construction of gravity sanitary sewers; furnishing, placing, and maintaining all sheeting, shoring, bracing, and timbering necessary for the proper protection and safety of the work, the workforce, the public, and adjacent property and improvements; the dewatering of trenches and other excavations; the preparation of satisfactory pipe beds; the backfilling and compaction of trenches, foundations, and other structures; the removal of unsuitable material from outside the normal limits of excavation, and where ordered by the Engineering, their replacement with suitable materials; and all other grading or excavation work incidental to or necessary for the work.

1.2 PERMITS AND NOTIFICATIONS

The Contractor shall be responsible for obtaining all the local permits, **to include street cut permits,** required and for notifying Tennessee One Call to locate all the existing utilities.

1.3 RELATED WORK SPECIFIED ELSEWHERE

Refer to following Sections of these Specifications for work related to this Section:

A. Section 01568 – Erosion and Sediment Control
B. Section 02100 – Site Preparation

PART 2 – PRODUCTS

2.1 NOT APPLICABLE

PART 3 – EXECUTION

3.1 TRENCH EXCAVATION

All excavation shall be by open cut unless otherwise shown on the plans or specified herein. No tunneling shall be done without the approval by the Engineer of the tunnel

cross section and details of construction. The top portion of trenches may be excavated with sloping or vertical sides to any width which will not cause damage to adjoining structures, roadways, pavements, utilities, or private property and which comply with all OSHA and TOSHA Standards. For untimbered trenches or trenches held by stay bracing only, except trenches excavated in rock using a trenching machine, the width of the lower portion of the trench to a height of two (2) feet above the top of the pipe shall not exceed 4/3d + 15" where d represents the nominal internal diameter of the pipe in inches. The width of trenches where skeleton or solid sheeting is used may be increased to dimensions approved by the Engineer, but not greater than necessary to clear the whalers when lowering pipe into the trench.

When approved in writing by the Engineer, the banks of trenches from the ground surface down to a depth not closer than two (2') feet above the top of the pipe may be excavated to nonvertical and nonparallel plans, provided the excavation below that depth is made with vertical and parallel sides equidistant from the pipe centerline in accordance with the criteria given above and provided they comply with all OSHA and TOSHA Standards. Any cut made in excess of the formula 4/3d + 15", except as noted above, shall be at the expense of the Contractor and may be cause for the Engineer to require that stronger pipe and/or a higher class of bedding be used.

Should the Contractor excavate below the required depth, the Contractor shall, at no cost to the Owner, bring the excavation to proper grade by filling the void with clean crushed stone size No. 67 as given in Section 903 of the latest Tennessee Department of Transportation Standard Specifications for Road and Bridge Construction.

Wherever muck, quicksand, soft clay, swampy ground, or other material unsuitable for foundations, subgrade, or backfilling is encountered, remove it and continue excavation until suitable material is encountered. The material removed shall be disposed of in the manner described in paragraph 3.4 Disposal of Materials. Refill the areas excavated for this reason with one to two (1" to 2") inch crushed stone up to the level of the lines, grades, and/or cross sections shown on the Plans. The top six (6") inches of this refill shall be crushed stone size No. 67 as given in Section 903 of the latest Tennessee Department of Transportation Standard Specifications for Road and Bridge Construction.

Trenches shall be opened up far enough ahead of pipe laying to reveal obstructions, but in general shall not include more than two hundred (200') feet of continuous open trench at any time. The Contractor will be required to follow up trenching operations promptly with pipe laying, backfill if an inspector is present, and rough cleanup, and in the event of failure to do so, may be prohibited from opening additional trench until such work is completed. This requirement is particularly applicable to work being done in developed areas.

Where trenches cross streets, walks, driveways, and other points as may be directed by the Engineer, the trenches shall be bridged in an open and secure manner, so as to prevent any serious interruption of travel upon the roadway or sidewalks, and also to afford necessary access to public or private premises. No driveways shall be cut or blocked without giving twenty-four (24) hour notice to the occupant of the property. Effort shall be made to schedule the blocking of drives to suit the occupant's convenience, and except

in case of emergency, drives shall not be blocked without an alternate access being provided. The material used, and the mode of construction of said bridges and the approaches thereto, must be satisfactory to the Engineer.

3.2 EXCAVATION FOR MANHOLES AND OTHER STRUCTURES

Excavation for manholes and other incidental structures shall not be greater in horizontal area than that required to allow a two (2') foot clearance between the outer surface of the structure and the walls of the adjacent excavation or of the sheeting used to protect it. The bottom of the excavation shall be true to the required shape and elevation shown on the Plans. No earth backfilling will be permitted under manholes or similar structures. Should the Contractor excavate below the elevations shown or specified, the Contractor shall, at no cost to the Owner, fill the void with either concrete or clean crushed stone size No. 67 as given in Section 903 of the latest Tennessee Department of Transportation Standard Specifications for Road and Bridge Construction. Excavation for manholes and other structures may be performed with nonvertical banks except beneath pavements or adjoining existing improvements.

3.3 EXCAVATION IN SOLID ROCK

Solid rock shall consist of such materials in the original bed or well defined ledges which, in the opinion of the Engineer, cannot be removed with pick and shovel, ditching machine, backhoe, or other similar devices, and which requires drilling and blasting, or the use of jackhammers or bullpoints. Concrete and masonry structures that require drilling and blasting for removal shall be considered as rock unless otherwise provided for herein. Boulders or detached pieces of rock having volumes of more than nine (9) cubic feet shall also be considered as rock. All rock shall be removed to provide a clearance of not less than nine (9") inches, (eighteen (18") inches when a trenching machine is used), in any horizontal direction from all parts of pipe, fittings and other appurtenances.

Excavate rock over the horizontal limits of excavation and to a depth of not less than six (6") inches below the bottom of the structure or pipe. Then backfill the space below grade with crushed stone size No. 67 as given in Section 903 of the latest Tennessee Department of Transportation Standard Specifications for Road and Bridge Construction, or other approved material, tamp to the proper grade, and make ready for construction.

Where sewers are constructed across cultivated fields and pastures, or in streets, excavated rock shall not be mixed with backfill material used to complete the final **eight (8")** inch layer of backfill at the original ground surface. Surplus rock shall be removed and wasted at points designated by the Owner.

Blasting operations shall be conducted in strict accordance with all existing ordinances and regulations, and shall be done only after a pre-blast survey is done at no cost to the Owner by a firm approved by the Engineer. All exposed structures shall be carefully protected from the effects of the blast, and all blasts shall be covered with heavy timbers or other suitable material. The blasting shall be done only by experienced personnel

certified by the State of Tennessee Fire Marshal's Office. Any damage done shall be promptly repaired at the Contractor's expense.

Rock excavation in proximity to other pipes or structures shall be conducted with the utmost care to prevent damage to the existing pipes or structures, and any such damage caused shall be promptly repaired at the Contractor's expense. Blasting operations shall not be conducted within ten (10') feet of finished sewer or water pipe. Contractor shall blast an additional five (5') feet beyond the proposed end of the service line, stub line or dead end manhole.

Extreme care shall be exercised in blasting, with signals of danger given before the firing of any charge. The Contractor shall, in all acts, conform to and obey all rules and regulations for the protection of life and property that may be imposed by any public authorities or that may be made from time to time by the Engineer, relative to the storing and handling of explosives and the blasting operations.

Where rock is encountered in the immediate vicinity of gas mains, telephone cables, building footings, gasoline tanks, or other hazardous areas, the Contractor shall remove the rock by means other than blasting. Care shall be taken in blasting operations to see that pipe or other structures previously installed are not damaged by blasting.

3.4 DISPOSAL OF MATERIALS

Excavated material shall be stored safely away from the edge of the trench and in such a way as to avoid encroachment on private property, danger to workers, utilities, or traffic, and to cause minimum inconvenience through blocking of drives, sidewalks, natural drains, etc.

Any surplus excavated material remaining after the trench backfill has been completed shall be removed from the site by the Contractor. The material may be stockpiled in a suitable location for use in correcting any future trench settlement if it meets the requirements of acceptable backfill. Surplus excavated material may be disposed of in other locations only after the Owner and the property owner have given permission, and have indicated that the material is not required on site.

Excavated material which is unsuitable for use in backfill, or surplus excavated material which is not desired by the Owner or the property owner, shall be hauled away and disposed of in an acceptable manner by the Contractor.

There shall be no disposal of materials allowed in the flood way or flood plain. Contractor is responsible for obtaining approval from all applicable agencies and/or property owners for any disposal sites. Copies of all approvals and agreements to be submitted to the Owner.

3.5 DEWATERING TRENCHES

The Contractor shall be responsible for handling storm water runoff, ground water, and sewage in such a way as to maintain trenches and excavations in a dry condition until the

work is completed. Pumps, piping, well points, labor, fuel, and other facilities necessary to control, intercept, remove and/or dispose of water shall be provided at the Contractor's expense.

Water shall be kept out of trenches and other excavations to the extent necessary to protect the supporting strength of the foundation material, permit efficient and satisfactory assembly or replacement of facilities, and to prevent floating or misalignment.

All water pumped or drained from the work shall be disposed of in a manner satisfactory to the Engineer without damage to adjacent property or to other work under construction. The Contractor shall not dispose of storm or surface water through new or existing sanitary sewerage facilities.

No pipe shall be laid in water, and water shall not be allowed to run over masonry until concrete or mortar has set at least forty-eight (48) hours.

The dewatering of the excavation shall be considered an integral part of the excavation work, and no separate payment will be allowed therefore. Where the Contractor fails, refuses, or neglects to control water in trenches or other excavations, and corrective work is deemed by the Engineer to be necessary as a consequence thereof, such work shall be at the Contractor's expense.

3.6 BRACING, SHEETING, SHORING, AND TRENCH BOXES

A. The Contractor shall provide such bracing, sheeting, shoring, or trench boxes as may be necessary for the protection of life and property. The Contractor shall be solely responsible for determining when and where to use bracing, sheeting, shoring, or trench boxes in order to protect all employees during the pipe laying operation. The Contractor shall comply with all OSHA and TOSHA standards in determining where and in what manner bracing, sheeting, shoring, or trench boxes are to be used. The Contractor has the sole responsibility for the safety of all employees, the effectiveness of the system, and any damages or injuries resulting from the lack or inadequacy of sheeting, shoring, and bracing. Where excavations are made adjacent to existing buildings or structures or in paved streets or alleys, the Contractor shall take particular care to sheet, shore, and brace the sides of the excavation so as to prevent any undermining of or settlement beneath such structures or pavement. The Contractor shall decide when it is necessary to underpin adjacent structures wherever necessary, with the approval of the Engineer.

B. Bracing, sheeting, or shoring shall conform to applicable safety codes, and shall be left in place until the pipe is laid, checked, and backfilled to a safe level at or above the top of the pipe. The bracing or sheeting and shoring may then be removed in an approved manner unless the Engineer specifically directs that the sheeting be left in place. Where the sheeting is left in place, either at the direction of the Engineer or option of the Contractor, the sheeting shall be cut off at least eighteen (18") inches below the finished ground level.

C. The Contractor may use a trench box, which is a prefabricated movable trench shield composed of steel plates welded to a heavy steel frame. The trench box shall be designed to provide protection equal to or greater than that of an appropriate shoring system and shall comply with all OSHA and TOSHA standards.

3.7 FOUNDATION STABILIZATION

After the trench is opened and grade established, it will be examined by the Engineer who will determine whether or not it is satisfactory foundation for pipes and/or appurtenances, or if it is necessary to stabilize the base. The Engineer may order the Contractor to undercut the trench and refill with one to two (1" to 2") inch crushed stone, except that the top six (6") inches of this refill shall be size No. 67 as given in Section 903 of the latest Tennessee Department of Transportation Standard Specifications for Road and Bridge Construction. The stone so placed shall be brought to the subgrade required by the class of bedding for the particular location and compacted.

3.8 BEDDING

Three general classes of bedding for the installation of gravity sanitary sewers in a trench condition are shown on the Standard Detail Drawings and described as follows:

A. CLASS "A" BEDDING

Class "A" bedding shall be a concrete cradle constructed in accordance with the methods shown on the Standard Detail Drawings. Concrete shall be Class "B" and shall be poured to the full width of the trench. Pipe shall be laid to line and grade on concrete blocking, after which the concrete shall be placed to the limits shown.

B. CLASS "B" BEDDING

Class "B" bedding shall be a compacted coarse, granular material placed on a flat bottom trench. The Contractor shall bring the crushed stone bedding up to the required level and shall then shape the bedding to receive the pipe. Bell holes shall be dug so that the bottom of the bells will not support the pipe. Once the pipe is in place, the crushed stone shall be brought up to a minimum of twelve (12") inches above the top of the pipe, thus completing the bedding of the pipe.

C. CLASS "C" BEDDING

Class "C" bedding shall be either a compacted, coarse, granular material placed on a flat bottom trench (Class "C-1"), or a hand shaped subgrade (Class "C-2") constructed in accordance with the methods shown on the Standard Detail Drawings.

Class "C-1" bedding shall be a compacted, coarse, granular material placed on a flat bottom trench. The Contractor shall bring the crushed stone bedding up to the

required level and shall then shape the bedding to receive the pipe. Bell holes shall be dug so that the bottom of the bells will not support the pipe. Once the pipe is in place, the crushed stone shall be brought up to a minimum of six (6") inches above the top of the pipe, thus completing the bedding of the pipe.

For Class "C-2", the Contractor shall hand shape the bottom of the trench to receive the pipe, and excavate the bell holes so that the bottom of the bells will not support the pipe. Once the pipe is in place, selected backfill shall be hand placed and tamped up to a minimum of eighteen (18") inches above the top of the pipe, thus completing the bedding of the pipe.

Special conditions for use of bedding classifications are as follows:

A. Install gravity sewers on Class "A" bedding only where indicated, specified, or authorized.

B. Unless otherwise indicated or authorized, all PVC gravity sewer pipe shall be installed on Class "B" bedding.

C. Unless otherwise indicated, specified, or authorized, all gravity sewer pipe, except PVC pipe, shall be installed on Class "C-1" bedding.

D. Unless otherwise indicated or authorized, all PVC force main pipe and all ductile iron force main pipe installed in rock trenches shall be installed on Class "C-1" bedding.

E. Unless otherwise indicated or authorized, all ductile iron force main pipe installed in earth trenches shall be installed on Class "C-2" bedding.

Class "B" concrete to be used in Class "A" bedding shall have a minimum compressive strength of three thousand (3,000) pounds per square inch in twenty-eight (28) days and shall contain not less than five hundred fifty (550) pounds of cement per cubic yard.

The crushed stone material to be used for pipe bedding shall be equal to size No. 67 as given in Section 903 of the latest Tennessee Department of Transportation Standard Specifications for Road and Bridge Construction.

3.9 BACKFILLING

All trenches shall be backfilled immediately after pipes are laid therein and inspected by the Engineer, unless other protection of the pipeline is directed.

Three classes of acceptable backfill material and placement procedures are described as follows:

A. SELECTED BACKFILL

Selected backfill material shall consist of finely divided earth, or other approved material carefully placed about the pipe and up to a height above the top of the pipe barrel as shown on the Standard Detail Drawings for the respective classes of bedding. Material shall be placed in uniform layers not exceeding nine (9") inches in thickness, each layer thoroughly compacted with proper hand tools in such manner as not to disturb or injure the pipe. Backfilling shall be carried on simultaneously on both sides of the pipe in such manner that injurious side pressures do not occur. If suitable select materials are not available from trench excavation, the Contractor will be required to obtain them elsewhere.

B. GENERAL BACKFILL

After bedding has been placed and tamped, the remainder of the trench may be backfilled with general excavated material, provided no rock which is of dimension no greater than six (6") inches along any axis, shall be used for backfill. Backfill material shall be placed in uniform layers not exceeding nine (9") inches in thickness with each layer thoroughly compacted with heavy duty power tamping equipment of the "Wacker" type, to the full satisfaction of the Engineer. The use of power "Jumping Jack" tampers will not be permitted. At locations outside roads, streets, walks, or other traveled ways open to vehicular or pedestrian travel, the Engineer may waive the requirement of power compaction of backfill upon written request of the Contractor; in which case, after placing the remainder of the backfill up to a level slightly below the natural ground surface, surplus excavation shall be windrowed and maintained in a suitable manner to concentrate and pond surface runoff from rains over the trench; after sufficient settlement has been obtained in the opinion of the Engineer, the Contractor shall complete the dressing, removal of surplus material, and surface cleanup in accordance with the Specifications.

C. CRUSHED STONE

Crushed stone/pug mill mix backfill is required for sanitary sewers installed in or across streets, except streets being constructed in new subdivisions, in or across state highways, across drives and other paved or traveled areas. The pug mill mix shall be No. 30301 as given in Section 903 of the latest Tennessee Department of Transportation Standard Specifications for Road and Bridge Construction. However, the Tennessee Department of Transportation may require or permit special backfill treatment. Pug mill mix backfill shall be placed in layers or lifts not exceeding twelve (12") inches in thickness. After placing in layers, pug mill mix shall be carefully compacted to maximum density or minimum volume with a vibratory type compactor. Such backfill, placed where called for on the Plans or as directed by the Engineer, shall be designated as Pug Mill Mix Backfill.

Backfilling around manholes and other structures in streets, state highways, and other paved areas shall consist of pug mill mix as described under (C) Crushed Stone. Backfill around manholes, piers, or other structures in locations not

subject to traffic may consist of excavated material subject to the following restrictions:

1. No rock larger than six (6”) inches in any dimension shall be placed within six (6”) inches of the manhole, structure or pipes entering or leaving the manhole.

2. No rock larger than six (6”) inches in any dimension shall be placed in the vertical prism above and extending nine (9”) inches outside of the pipelines.

3. Crushed stone shall be used under, around, and over the tops of any pipes entering or leaving the manholes as required by the class of bedding for the pipe of a particular material or at a particular location.

4. Excavated material used for backfill shall be carefully placed in layers and compacted in such manner as to fill all voids and prevent excessive settlement.

D. FINAL GRADING AND TOPSOILING

This shall include the separation and redepositing of topsoil, final grading and raking of all areas disturbed by construction operations across public and/or private property.

Topsoil may be the topsoil originally excavated from the area and separated from the common excavation for redepositing under this item if suitable soils are encountered, or topsoil obtained off the site of the work from other sources by the Contractor and satisfactory to the Engineer. All arrangements and expenses for securing, loading, hauling and spreading topsoil shall be by the Contractor.

The topsoil shall be deposited and spread so that the top 8 inches of the disturbed area is rock free.

The Contractor shall be responsible for and shall protect all sewers, storm sewers and electric, telephone, water, or other pipes or conduits against danger or damage while excavated areas are being backfilled and from future settlement of the backfill. In all instances, sufficient care must be exercised to avoid leaving any holes or voids in trench walls which may later be filled by leaching or settlement of surrounding material thereby causing future trench settlement. Where damage should occur as a result of the Contractor’s backfilling operations or from settlement, such damage shall promptly be repaired.

Whenever the trenches have not been properly filled, or if settlement occurs, they shall be refilled, smoothed off, and finally made to conform to the surface of the ground. Backfilling shall be carefully performed, and the original surface

restored to the full satisfaction of the Engineer. Surplus material shall be disposed of as directed by the Engineer.

Where excavated material is not suitable for use as backfill material, CONTRACTOR shall provide acceptable backfill material from other sources at no extra cost.

END OF SECTION 02221S